# Characterization of Oxygenated Diesel Fuels with the Advanced Distillation Curve Method

Thomas Bruno [C, S], Tara Lovestead, and Jessica Burger
*NIST, Thermophysical Properties Division, U.S.A.*
*bruno@boulder.nist.gov*

While very efficient, diesel engines are known to produce a significant quantity of particulate matter as products of combustion. As a result, there is a great deal of interest in formulating oxygenated diesel fuels that produce low particulate emissions. The most common oxygenate additives for diesel fuels include the glycol ethers, glycol esters, alcohols, ethers and ketones. It is important to characterize the mixture properties of diesel fuel with oxygenate additives, in order to assess the degree of departure of the oxygenated fuels from the base fuel. One of the most important properties to use for this purpose is the volatility, as expressed by the distillation curve. We have recently introduced several important improvements in the measurement of distillation curves of complex fluids. The modifications, incorporated into the advanced distillation curve method (ADC) provide for (1) a composition-explicit data channel for each distillate fraction (for both qualitative, quantitative and trace analysis), (2) temperature measurements that are true thermodynamic state points that can be modeled with an equation of state, (3) temperature, volume and pressure measurements of low uncertainty suitable for equation of state development, (4) consistency with a century of historical data, (5) an assessment of the energy content of each distillate fraction, and (6) a corrosivity assessment of each distillate fraction. In this presentation, we present ADC measurements on diesel fuels with approximately 50 oxygenating fluids, contrasting the behavior and exploring the departure from the experience base of typical diesel fuels. Finally, we show how the method can facilitate the development of thermodynamic models for these complex fluids.